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Title: MAGNETIC DETECTION OF CHEMICAL THREATS

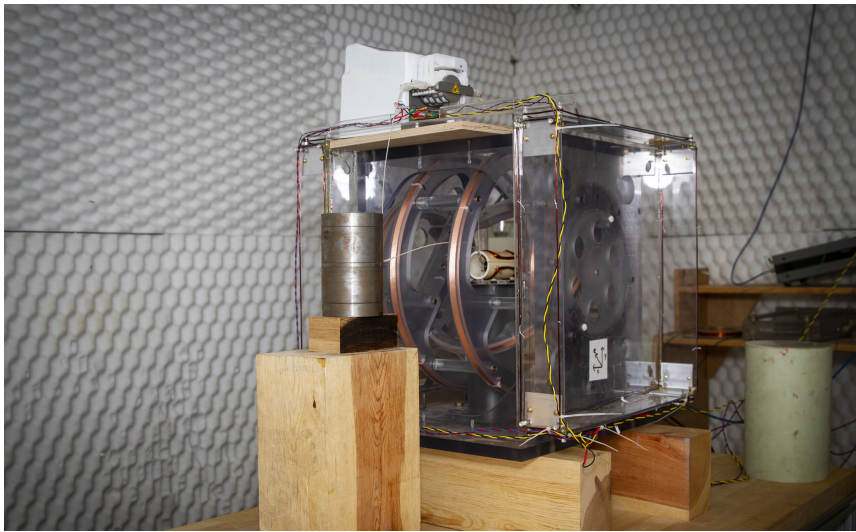
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Tech Snapshot Sensors

Published: Sep 18, 2020

MAGNETIC DETECTION OF CHEMICAL THREATS

*Portable chemical threat detectors using
earth's magnetic field*



SUMMARY

Los Alamos researchers have developed a technology to quickly detect chemical threats using a fieldable detector that provides real-time detection to ensure safety for warfighters, agricultural workers, and the general public. Traditional laboratory-based detection does not allow for agile response to threats on the battlefield or to our food supply chain. Our portable detector brings the laboratory to the field for real-time detection of chemical agents in samples without needing to send the samples to a remote location for analysis. This technology fits a market need in public safety, military sensor design, and pesticide detection. We have proven that this technology works on the benchtop, and are working to miniaturize the system to enable deployment. We are seeking qualified licensing or CRADA partners to finalize development of this system.



MARKET APPLICATION

This technology addresses an urgent need for real-time fieldable detection of hazardous chemicals in the defense, chemical synthesis, agriculture, and waste treatment markets. Chemical warfare agents have become a realistic threat to public safety in recent years and we urgently require accurate and safe analytical diagnostic technologies in the field for our troops. The military sensors (detectors) market is projected to be \$33.2 B with a compound average growth rate (CAGR) of 5.1% from 2019 to 2025. (Military Sensors Market by Application – Global Forecast to 2025, Markets and Markets).

BENEFITS

This device provides a best in class compact and portable solution for detection of chemical threats in the field. The non-destructive nature and limited background interference provides exceptional performance in a wide range of operating conditions.

- Small, lightweight, battery-powered, and low cost - ideal for portability
- Samples can be analyzed in either liquid or solid matrices
- Exploits a signature space with limited background interference
- Sample measurement is automated and uses small, contained samples
- Spectra are unique and serve as a fingerprint to identify chemical threats
- Demonstrated detection of chemicals through various pipe materials

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WHY WE ARE BUILDING MAGNETIC DETECTION OF CHEMICAL THREATS

We set out to develop a fieldable sensor to detect chemical weapons agents. Detection in the field provides real-time detection to ensure safety for warfighters, agricultural workers, and the general public. This immediate detection capability ensures accurate identification for rapidly decomposing chemicals that are not amenable to transportation to a remote laboratory. It became clear that this sensor has applications beyond those of the military, such as in civilian security. We need to be able to detect harmful, toxic chemicals, such as chemical warfare agents and related chemical threats in field situations that may not be amenable to lengthy and remote laboratory analysis. This instrument can be used for forensic attribution of chemical warfare agents or as a new agricultural screening technology for pesticide detection.



WHAT'S BEHIND OUR TECHNOLOGY

This technology is different because it uses earth's magnetic field to create a unique signature space that only emerges under the presence of chemical agents. As such, a positive indication cannot be generated by a different class of chemical. Similar fieldable technologies suffer from background interference and overlapping signatures, making identification challenging if not impossible. We have utilized earth's magnetic fields to ensure a high-resolution, low cost instrument. By implementing microfluidics sample containment, the instrument is miniaturized to a portable version that allows for rapid, accurate, and safe identification of small volumes and dilute solutions of hazardous and toxic chemicals.



OUR COMPETITIVE ADVANTAGES

This technology is the first automated, fluid-based system for magnetic detection of chemical threats. The current instrument can detect orders of magnitude less sample than similar instruments. The instrument is small enough for field use and can be implemented alongside traditional screening techniques for enhanced threat detection. Finally, this technology works with earth's magnetic field and negates the need to do sampling in most applications.



OUR TECHNOLOGY STATUS

We have successfully demonstrated this technology in the laboratory on over 30 unique molecules, including pesticides, and have determined that the spectra serve as fingerprints for the molecules. Further we have measured the signatures from chemical warfare agents surrogates, decomposition products, and synthetic precursors. Finally, we have conclusive evidence that common background signatures are invisible to this technology. We are seeking qualified licensing or CRADA partners to finalize development of this system.



PUBLICATIONS AND IP

U.S Patent application 16/806,862 "Methods and Systems for J-coupled Nuclear Magnetic Resonance" Filed March 2, 2020

Kaseman et al. Rev. Sci. Instr. 91 054103 (2020)

Kaseman et al. Appl. Sci. 10(11) 3836 (2020)